

Fisher® 646 Electro-Pneumatic Transducer

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Figure 1. Fisher 646 Electro-Pneumatic Transducer
Mounted on a Sliding-Stem Actuator



W6783-1/L

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Introduction

Scope of Manual

This instruction manual provides installation, operation, maintenance, and parts ordering information for the Fisher 646 transducer. Refer to separate manuals for instructions covering equipment used with the transducer.

Do not install, operate or maintain a 646 electro-pneumatic transducer without being fully trained and qualified in valve, actuator and accessory installation, operation and maintenance. To avoid personal injury or property damage it is important to carefully read, understand, and follow all of the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your Emerson Process Management sales office before proceeding.



Table 1. Specifications

Input Signal 4-20 mA DC, constant current with 30 VDC maximum compliance voltage	Emissions—Class A ISM equipment rating: Group 1, Class A
Equivalent Circuit The 646 equivalent circuit is a series circuit consisting of a constant voltage drop (battery) of approximately 2.1 VDC and a total resistance of 143 ohms. Input is shunted by three 6.8 V zener diodes (see figure 6).	Operating Ambient Temperature Limits⁽¹⁾ -40 to 71°C (-40 to +160°F)
Output Signal 0.2 to 1.0 bar (3 to 15 psig) direct acting only	Electrical Classification CSA—Intrinsically Safe, Explosion proof, Type n, Dust-Ignition proof, DIV 2 FM—Intrinsically Safe, Explosion proof, Type n, Non-incendive, Dust-Ignition proof ATEX—Intrinsically Safe, Flameproof, Type n IECEx—Intrinsically Safe, Flameproof, Type n Refer to Hazardous Area Classifications and Special Instructions for the “Safe Use” and Installation in Hazardous Locations starting on page 5 for additional information.
Supply Pressure⁽¹⁾ Recommended: 1.4 bar (20 psig) Minimum: 1.4 bar (20 psig) Maximum: 3.4 bar (50 psig)	Housing CSA—Type 3 Encl. FM—NEMA 3, IP54 ATEX—IP64 IECEx—IP54 Mount instrument with vent on side or bottom if weatherproofing is a concern.
Average Steady-State Air Consumption⁽²⁾⁽³⁾ 0.08 m ³ /hr (3 scfh) at 1.4 bar (20 psi) supply pressure	Other Classifications/Certifications INMETRO —National Institute of Metrology, Quality and Technology (Brazil) KGS—Korea Gas Safety Corporation (South Korea) Contact your Emerson Process Management sales office for classification/certification specific information
Maximum Output Air Capacity⁽²⁾ 8.0 m ³ /hr (300 scfh) at 1.4 bar (20 psig) supply pressure	Connections Supply and Output Pressure: 1/4 NPT internal connection Vent: 1/4 NPT internal Electrical: 1/2-14 NPT conduit connection Wire Size: 18 to 22 AWG
Performance⁽⁴⁾ Reference Accuracy: $\pm 0.5\%$ of full scale output span; includes combined effects of hysteresis, linearity, and deadband Independent Linearity: $\pm 0.5\%$ of full scale output span Hysteresis: 0.4% of full scale output span Frequency Response: Gain is attenuated 3 dB at 10 Hz with transducer output signal piped to a typical instrument input Temperature Effect: $\pm 4\%$ of full scale output span per 55°C (100°F) change Supply Pressure Effect: 0.2% of full scale output span per psi supply pressure change Vibration Effect: Less than 1% of full scale output span when tested to SAMA PMC 31.1, Condition 3 Electromagnetic Compatibility Meets EN 61326-1 (First Edition) Immunity—Industrial locations per Table 2 of the EN 61326-1 standard. Performance is shown in table 2 below.	Adjustments Zero and Span: Trim potentiometers (20 turn) for zero and span adjustments are located under the housing cap (see figure 7)

-continued-

Table 1. Specifications (Continued)

Mounting Position	Declaration of SEP
Any position is acceptable for standard pipestand, panel, or actuator mounting. For weatherproof housing, mount the transducer so the vent can drain.	Fisher Controls International LLC declares this product to be in compliance with Article 3 paragraph 3 of the Pressure Equipment Directive (PED) 97 / 23 / EC. It was designed and manufactured in accordance with Sound Engineering Practice (SEP) and cannot bear the CE marking related to PED compliance.
Approximate Weight (Transducer Only) 1.6 kg (3.5 pounds)	However, the product <i>may</i> bear the CE marking to indicate compliance with other applicable European Community Directives.
Actuator Stroking Time See figure 2	

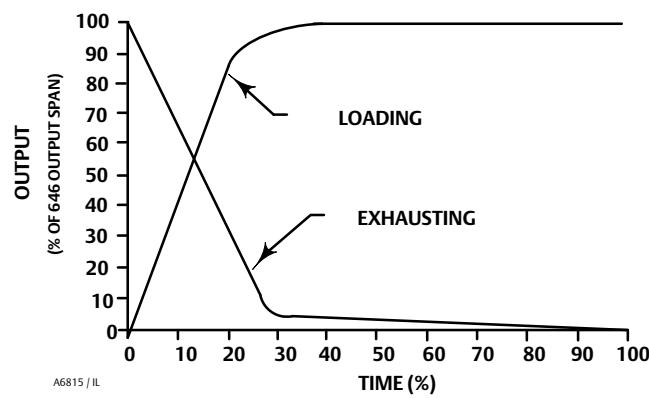
NOTE: Specialized instrument terms are defined in ANSI/ISA Standard 51.1 - Process Instrument Terminology.
 1. The pressure and temperature limits in this document and any applicable standard or code limitation should not be exceeded.
 2. Normal m³/hr—Normal cubic meters per hour (0°C and 1.01325 bar, absolute). Scfh—Standard cubic feet per hour (60°F and 14.7 psia).
 3. Average flow rate determined at 12 mA and 0.6 bar (9 psig) output.
 4. Performance values are obtained using a transducer with a 4 to 20 mA DC input signal and a 0.2 to 1.0 bar (3 to 15 psig) output signal at an ambient temperature of 24°C (75°F).

Table 2. EMC Summary Results—Immunity

Port	Phenomenon	Basic Standard	Test Level	Performance Criteria ⁽¹⁾
Enclosure	Electrostatic discharge (ESD)	IEC 61000-4-2	4 kV contact 8 kV air	A
	Radiated EM field	IEC 61000-4-3	80 to 1000 MHz @ 10V/m with 1 kHz AM at 80% 1400 to 2000 MHz @ 3V/m with 1 kHz AM at 80% 2000 to 2700 MHz @ 1V/m with 1 kHz AM at 80%	A
I/O signal/control	Burst (fast transients)	IEC 61000-4-4	1 kV	A
	Surge	IEC 61000-4-5	1 kV (line to ground only, each)	B
	Conducted RF	IEC 61000-4-6	150 kHz to 80 MHz at 3 Vrms	A

1. A = No degradation during testing. B = Temporary degradation during testing, but is self-recovering.
 Specification Limit = +/- 1% of span.

Figure 2. Output-Time Relationships for Fisher 646 Transducer



Description

The transducer, shown in figure 1, receives a 4-20 milliampere DC input signal and transmits a proportional 0.2 to 1.0 bar (3 to 15 psig) pneumatic output pressure to a final control element. A typical application is in electronic control loops where the final control element is a control valve assembly that is pneumatically operated. The input signal and output pressure range of the transducer is indicated on the nameplate attached to the housing.

CAUTION

Dropping or rough handling of the transducer can cause damage to the converter module resulting in a shifted output or a minimum output.

⚠ WARNING

This product *does not* meet third party approvals (CSA, FM, ATEX, or IECEx) for use with natural gas as the supply medium. Use of natural gas as the supply medium can damage the instrument and result in personal injury or property damage from fire or explosion.

Should you need an instrument for use with natural gas, Fisher 846 and i2P-100 electro-pneumatic transducers both meet third party approvals for use with natural gas as the supply medium. Contact your Emerson Process Management sales office for information on these products.

Specifications

Specifications for the 646 transducer are listed in table 1.

Educational Services

For information on available courses for the 646 electro-pneumatic transducer, as well as a variety of other products, contact:

Emerson Process Management
Educational Services, Registration
Phone: +1-641-754-3771 or +1-800-338-8158
e-mail: education@emerson.com
<http://www.emersonprocess.com/education>

Installation

⚠ WARNING

Always wear protective clothing, gloves, and eyewear when performing any installation operations to avoid personal injury.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

Hazardous Area Classifications and Special Instructions for “Safe Use” and Installation in Hazardous Locations

Certain nameplates may carry more than one approval, and each approval may have unique installation/wiring requirements and/or conditions of “safe use”. These special instructions for “safe use” are in addition to, and may override, the standard installation procedures. Special instructions are listed by approval.

Note

This information supplements the nameplate markings affixed to the product.

Always refer to the nameplate itself to identify the appropriate certification. Contact your Emerson Process Management sales office for approval/certification information not listed here.

⚠ WARNING

Failure to follow these conditions of “safe use” could result in personal injury or property damage from fire or explosion and area re-classification.

CSA

Intrinsically Safe, Explosion proof, Type n Dust-Ignition proof, DIV 2

No special conditions for safe use.

Refer to table 3 for additional information.

Table 3. Hazardous Area Classifications—CSA (Canada)

Certification Body	Certification Obtained	Entity Rating	Temperature Code
CSA	Intrinsically Safe Ex ia IIC T4/T5 per drawing GE28591 (see figure 12) Ex ia Intrinsically Safe Class I, II, Division 1 GP A,B,C,D,E,F,G T4/T5 per drawing GE28591 (see figure 12)	Vmax = 30 VDC Imax = 150 mA Pi = 1.0 W Ci = 0 nF Li = 0 mH	T4 (Tamb ≤ 71°C) T5 (Tamb ≤ 40°C)
	Explosion-proof Ex d IIC T6 Class I, Division I, GP A,B,C,D T6	---	T6 (Tamb ≤ 71°C)
	Type n Ex nL IIC T6	---	T6 (Tamb ≤ 71°C)
	Class I, Division 2, GP A,B,C,D T6 Class II, Division 1, Groups E,F,G T6 Class II, Division 2, GP F,G T6	---	T6 (Tamb ≤ 71°C)

FM

Intrinsically Safe, Explosion proof, Type n Non-incendive, Dust-Ignition proof

No special conditions for safe use.

Refer to table 4 for additional information.

Table 4. Hazardous Area Classifications—FM (United States)

Certification Body	Certification Obtained	Entity Rating	Temperature Code
FM	Intrinsically Safe Class 1 Zone 0 AEx ia IIC T4/T5 per drawing GE28590 (see figure 13) Class I, II, III Division 1 GP A,B,C,D,E,F,G T4/T5 per drawing GE28590 (see figure 13)	Vmax = 30 VDC Imax = 150 mA Pi = 1.0 W Ci = 0 nF Li = 0 mH	T4 (Tamb ≤ 71°C) T5 (Tamb ≤ 40°C)
	Explosion-proof Class 1 Zone 1 AEx d IIC T6 Class I, Division I, GP A,B,C,D T6	---	T6 (Tamb ≤ 71°C)
	Type n CL 1 Zone 2 AEx nL IIC T6	---	T6 (Tamb ≤ 71°C)
	Class I, Division 2, GP A,B,C,D T6 Class II, Division 1, Groups E,F,G T6 Class II, Division 2, GP F,G T6	---	T6 (Tamb ≤ 71°C)

ATEX

Standards Used for Certification

EN 60079-0: 2012	EN 60079-31: 2009
EN 60079-1: 2007	EN 61241-0: 2006
EN 60079-11: 2012	EN 61241-1: 2004
EN 60079-15: 2010	EN 61241-11: 2006

Special Conditions for Safe UseIntrinsically Safe

This equipment is intrinsically safe and can be used in potentially explosive atmospheres.

The electrical parameters of certified equipment which can be connected to the device must not exceed the following values: $U_0 \leq 30$ VDC ; $I_0 \leq 150$ mA ; $P_0 \leq 1$ W

Ambient temperature: T5, at Tamb = 40°C ; T4, at Tamb = 71°C

Flameproof

The flame path is other than required by EN 60079-1. Contact the manufacturer for information on the dimensions of the flameproof joints.

Electrical connections are typically made using either cable or conduit.

- If using a cable connection, the cable entry device shall be certified in type of explosion protection flameproof enclosure “d”, suitable for the conditions of use and correctly installed.

For ambient temperatures over 70°C, cables and cable glands suitable for at least 90°C shall be used.

- If using a rigid conduit connection, an Ex d certified sealing device such as a conduit seal with setting compound shall be provided immediately to the entrance of the enclosure.

For ambient temperatures over 70°C, the wiring and setting compound in the conduit seal shall be suitable for at least 90°C.

Type n

No special conditions for safe use.

Refer to table 5 for additional information.

Table 5. Hazardous Area Classifications—ATEX

Certificate	Certification Obtained	Entity Rating	Temperature Code
ATEX	Ex II 1 G & D	Ui = 30 VDC Ii = 150 mA Pi = 1.0 W Ci = 0 nF Li = 0 mH	
	Intrinsically Safe Gas Ex ia IIC T4/T5 Ga		T4 (Tamb ≤ 71°C) T5 (Tamb ≤ 40°C)
	Dust Ex ia IIIC Da T155 °C (Tamb ≤ 71°C) / T124°C (Tamb ≤ 40°C)		---
	Ex II 2 G & D		
	Flameproof Gas Ex d IIC T6 Gb	---	T6 (Tamb ≤ 71°C)
	Dust Ex tb IIIC T74 °C Db (Tamb ≤ 71°C)		---
	Ex II 3 G & D	---	
	Type n Gas Ex nA IIC T6 Gc		T6 (Tamb ≤ 71°C)
	Dust Ex tc IIIC T74 °C Dc (Tamb ≤ 71°C)		---

IECEx

Conditions of Certification

Intrinsically Safe

⚠ WARNING

Substitution of components may impair intrinsic safety.

-40°C ≤ Ta ≤ +71°C ; T5 (Ta ≤ +40°C) ; T4 (Ta ≤ +71°C)

Entity Parameters: U_i = 30 V , I_i = 150 mA , P_i = 1.0 W , C_i = 0 nF , L_i = 0 mH

Flameproof

⚠ WARNING

Disconnect power before opening.

-40°C ≤ Ta ≤ +71°C ; T6 (Ta ≤ +71°C)

Type n**⚠ WARNING****Disconnect power before opening.** $-40^{\circ}\text{C} \leq \text{Ta} \leq +71^{\circ}\text{C}$; $\text{T6} (\text{Ta} \leq +71^{\circ}\text{C})$

Refer to table 6 for additional information.

Table 6. Hazardous Area Classifications—IECEx

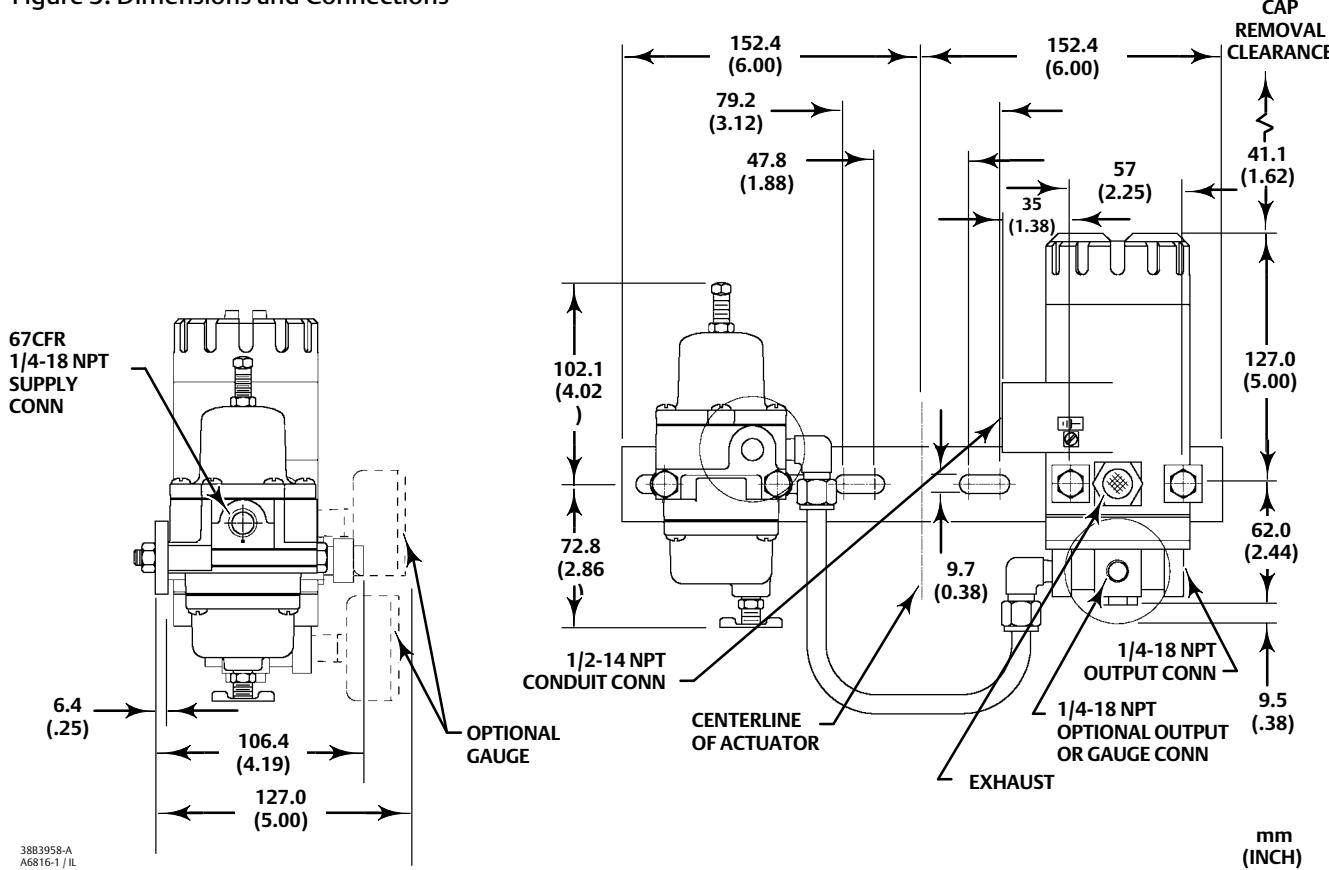
Certificate	Certification Obtained	Entity Rating	Temperature Code
IECEx	Intrinsically Safe Gas Ex ia IIC T4/T5 Ga	Ui = 30 VDC li = 150 mA Pi = 1.0 W Ci = 0 nF Li = 0 mH	T4 ($\text{Tamb} \leq 71^{\circ}\text{C}$) T5 ($\text{Tamb} \leq 40^{\circ}\text{C}$)
	Flameproof Gas Ex d IIC T6 Gb	---	T6 ($\text{Tamb} \leq 71^{\circ}\text{C}$)
	Type n Gas Ex nA IIC T6 Gc	---	T6 ($\text{Tamb} \leq 71^{\circ}\text{C}$)

Mounting

When a transducer is ordered as part of a control valve assembly, the factory mounts the transducer on the actuator and connects the necessary tubing, then adjusts the transducer as specified on the order.

Transducers also can be ordered separately for mounting on a control valve assembly already in service, or for mounting on a 2 inch diameter pipestand, a flat surface, or a bulkhead. The transducer may be ordered either with or without mounting parts. Mounting parts include a mounting plate and bolts and, if ordered for pipestand mounting, a pipe clamp. Tubing is not included if the transducer is not factory mounted. Use 10 mm (3/8-inch) diameter tubing for all input and output connections. The length of tubing between the transducer output and the final control element should be as short as possible. Transducer overall dimensions are shown in figure 3. If weatherproofing is required, mount the transducer so that the vent can drain. Do not allow moisture or condensate to collect in the vent.

Figure 3. Dimensions and Connections



Pneumatic Connections

As shown in figure 3, all pressure connections on the transducer are 1/4 NPT internal connections. Use 10 mm (3/8-inch) tubing for all pressure connections. Refer to the vent subsection below for remote vent connections.

Supply Pressure Requirements

⚠ WARNING

Severe personal injury or property damage may occur if the instrument air supply is not clean, dry and oil-free. While use and regular maintenance of a filter that removes particles larger than 40 micrometers in diameter will suffice in most applications, check with an Emerson Process Management field office and industry instrument air quality standards for use with corrosive air or if you are unsure about the proper amount or method of air filtration or filter maintenance.

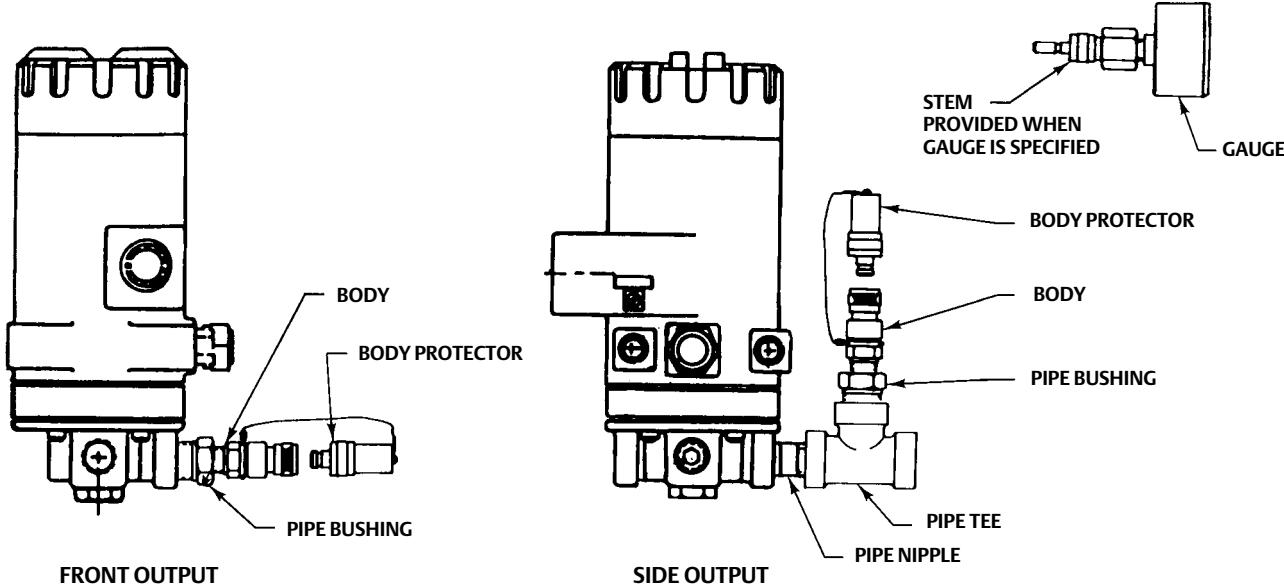
Supply pressure must be clean, dry air. Use a Fisher 67CFR filter regulator with standard 5 micrometer filter, or equivalent, to filter and regulate supply air. The filter regulator can be mounted on a bracket with the transducer as shown in figure 11 or mounted on the actuator mounting boss. An output pressure gauge may be installed on the regulator to indicate the supply pressure to the transducer. Also, as an aid for calibration, a second gauge may be installed on the transducer to indicate transducer output pressure.

Connect the nearest suitable supply source to the 1/4 NPT IN connection on the filter regulator (if furnished) or to the 1/4 NPT SUPPLY connection on the transducer case (if the filter regulator is not attached).

Diagnostic Connections

To support diagnostic testing of valve/actuator/positioner packages, special connectors and hardware are available. Typical connector installations are shown in figure 4. The hardware used includes a 1/4 NPT pipe nipple and pipe tee with a 1/8 NPT pipe bushing for the connector. The connector consists of a 1/8 NPT body and body protector.

Figure 4. Diagnostics Hookup for the Fisher 646 Transducer



12B8040-A
B2395-1/L

Note

If the 646 transducer is used in a valve assembly with a positioner, no hook-up for diagnostic testing is required for the 646. The hook-up for diagnostic testing should be installed at the positioner.

Install the connectors and hardware between the 646 transducer and the actuator.

1. Before assembling the pipe nipple, pipe tee, pipe bushings, actuator piping, and connector body, apply sealant to all threads.
2. Turn the pipe tee to position the connector body and body protector for easy access when doing diagnostic testing.

Vent

If a remote vent is required, the vent line must be as short as possible with a minimum number of bends and elbows. To connect a remote vent, remove the plastic vent (key 41, figure 10). The vent connection is 1/4 NPT internal. Use 3/8-inch tubing to provide a remote vent.

Electrical Connections

WARNING

For explosion-proof applications, disconnect power before removing the housing cap.

For explosion-proof Class 1, Division 1 applications using metal conduit, install a conduit seal no more than 457 mm (18 inches) from the transducer. Personal injury or property damage may result from explosion if the seal is not installed. For other explosion-proof applications, install the transducer in accordance with applicable codes.

⚠ WARNING

For proper wiring and installation for intrinsically safe installations, refer to the nameplate affixed to the product and loop schematics for CSA and FM (figure 12 and 13), or to instructions provided by the barrier manufacturer.

⚠ WARNING

Select wiring and/or cable glands that are rated for the environment of use (such as hazardous area, ingress protection, and temperature). Failure to use properly rated wiring and/or cable glands can result in personal injury or property damage from fire or explosion.

Wiring connections must be in accordance with local, regional, and national codes for any given hazardous area approval. Failure to follow the local, regional, and national codes could result in personal injury or property damage from fire or explosion.

Use the 1/2-14 NPT conduit connection, shown in figure 3, for installation of field wiring. For Class I, Division I explosion-proof applications, install rigid metal conduit and a seal no more than 457 mm (18 inches) from the transducer. Also, install conduit using local and national electrical codes which apply to the application.

Refer to figures 5, 6, and 7 when connecting field wiring from the control device to the transducer. Connect the positive wire from the control device to the transducer "+" terminal and, the negative wire from the control device to the transducer "-" terminal. Do not overtighten the terminal screws. Maximum torque is 0.45 N•m (4 lbf•in.). Connect the transducer grounding terminal to earth ground. Grounding terminals are provided both inside and outside the transducer housing.

Figure 5. Typical Field Wiring Diagram

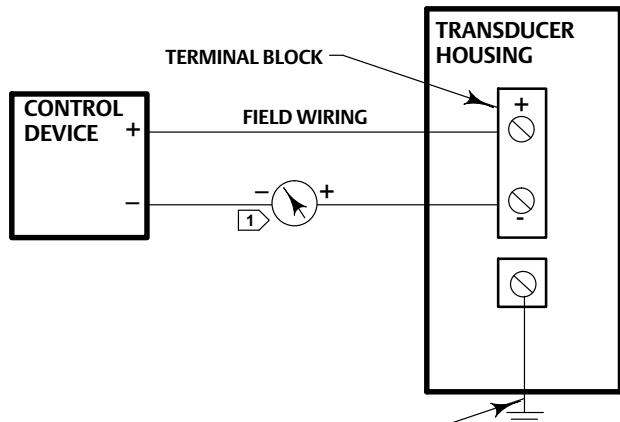


Figure 6. Equivalent Circuit

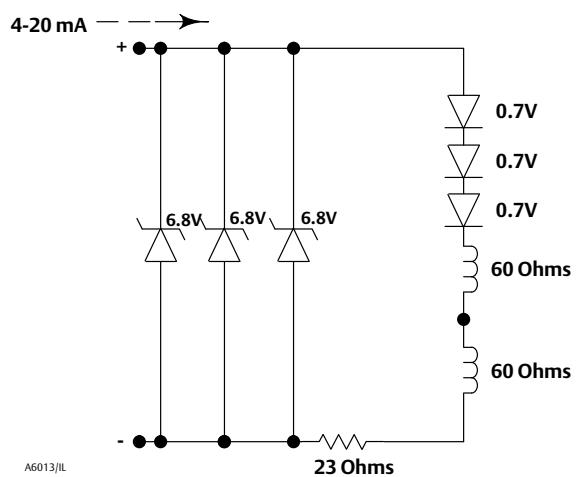
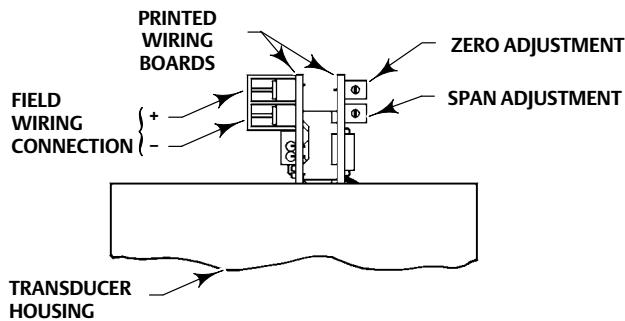


Figure 7. Zero and Span Adjustments and Terminal Block Connections (Cap Removed)



Operating Information

The normal mode of operation for the 646 transducer requires that the pneumatic output pressure be piped to the final control element. If this is not done the resulting pneumatic output will vent to the atmosphere.

Calibration

⚠ WARNING

On explosion-proof instruments, remove electrical power before removing the housing cap in a hazardous area. Personal injury or property damage may result from fire or explosion if power is applied to the transducer with the cap removed in a hazardous area.

For intrinsically safe areas, current monitoring during operation must be with a meter approved for use in hazardous areas.

Equipment Required

Choose a current or voltage source that is capable, without switching ranges, of driving the transducer through its entire input range. Switching ranges on a current or voltage source will produce spikes or mid-scale reverses in the input signal presented to the transducer, causing errors. The current source should be capable of delivering 30 mA with 30 VDC maximum compliance voltage.

Calibration Procedure

⚠ WARNING

For critical processes, this calibration procedure requires taking the final control element out of service. To avoid personal injury or property damage due to an uncontrolled process, provide some temporary means of process control before beginning the calibration procedure.

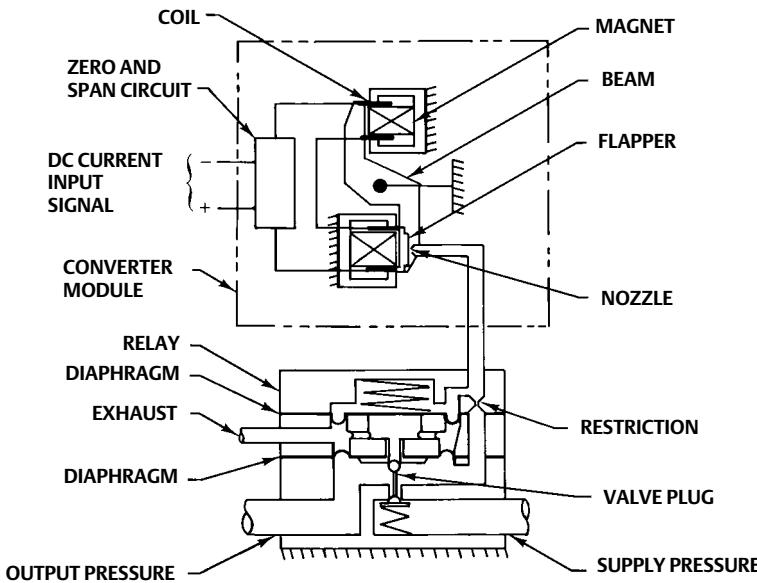
Refer to figure 7 for adjustment locations.

1. If a current source other than the control device is used as the input source, disconnect the control device and connect the current source positive terminal to the transducer "+" terminal and the current source negative terminal to the transducer "-" terminal.
If an external meter is used, connect the current source positive terminal to the transducer "+" terminal. Connect the meter positive terminal to the transducer "-" terminal and the meter negative terminal to the current source negative terminal as shown in figure 5.
2. Check the supply pressure to ensure it is at the recommended pressure listed on the transducer nameplate.
3. Adjust the input current to 4.00 milliamperes DC.
4. The output pressure should be 0.2 bar (3 psig). If not, adjust the ZERO potentiometer until the output pressure is 0.2 bar (3 psig).
5. Adjust the input current to 20.00 milliamperes DC.
6. The output pressure should be 1.0 bar (15 psig). If not, adjust the SPAN potentiometer until the output pressure is 0.8 bar (15 psig).
7. Repeat steps 2 through 6 until the output pressure is within the referenced accuracy requirements without further adjustment.
8. If a current source other than the control device was used, disconnect the current source and reconnect the control device.

Principle of Operation

The converter module receives a standard DC current input signal from a control device to operate coils in a force balanced beam system which in turn, controls bleed air through an integral nozzle/flapper arrangement. The nozzle pressure provides the input signal to operate the relay as shown in figure 8. Relay output pressure is applied, through tubing, directly to the final control element or valve/actuator assembly.

Figure 8. Fisher 646 Transducer Schematic



Maintenance

The normal mode of operation for the 646 transducer requires that the pneumatic output pressure be piped to the final control element. If this is not done the resulting pneumatic output will vent to the atmosphere.

Due to normal wear or damage from external sources such as debris in the supply medium, periodic maintenance or repair of the transducer may be necessary. Maintenance of the transducer consists of troubleshooting, removal for inspection, and replacement of component parts.

⚠ WARNING

To avoid personal injury or property damage from the sudden release of pressure:

- Always wear protective clothing, gloves, and eyewear when performing any maintenance operations.
- Do not remove the actuator from the valve while the valve is still pressurized.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- Do not open when an explosive dust atmosphere is present.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

⚠ WARNING

For explosion proof applications, disconnect power before removing the housing cap. Personal injury or property damage may result if power is not disconnected.

⚠ WARNING

The presence of Emerson Process Management personnel and approval agency personnel may be required if you service (other than normal, routine maintenance, such as calibration) or replace components on a 646 transducer that carries a third-party approval. When you replace components, use only components specified by the factory. Substitution with other components may void the third-party approval and result in personal injury or property damage. Also, always use proper component replacement techniques, as presented in this manual. Improper techniques can cause poor quality repairs and impair the safety features of the device.

The converter module should never be disassembled because the magnetism in the coils will decrease permanently. If troubleshooting or alignment attempts indicate a faulty converter module, replace the module or return the transducer to your Emerson Process Management sales office for repair.

Troubleshooting

The following procedures require taking the control valve/actuator assembly out of service. Provide some temporary means of process control before taking the control valve out of service.

Electrical

1. Ensure terminal lug connections from the control device to the transducer are of the correct polarity (refer to the electrical connection procedures in the Installation section).
2. At the transducer, ensure that the milliampere DC signal is applied and that it is within the 4 to 20 milliampere range.

Pneumatic

Provide a 4-30 milliampere DC current source, supply pressure, and a gauge to monitor the output pressure when checking transducer operation. Refer to figure 10 for key number locations.

1. Ensure that supply pressure to the transducer is a consistent 1.4 bar (20 psig).
2. If a filter/regulator is used, ensure that it is working correctly. If not, ensure the dripwell is not plugged because of excessive moisture accumulation. If necessary, drain off any moisture, and clean or replace the filter element.
3. Force the converter module to maximum output pressure with a 30 milliampere DC signal. Output pressure should build up to the approximate value of the supply pressure.
4. When the input current is removed, the transducer output pressure should drop to less than 0.14 bar (2 psig). If it does not, check to ensure the vent and exhaust air passageway is free from foreign material.
5. To inspect the relay assembly, refer to the relay maintenance procedures.

Converter Module Replacement

Removal

Refer to figure 10 for key number locations.

1. Remove the housing cap (key 4).
2. Note the location of the wires, then remove the electrical wiring from the terminal block mounted on the printed wiring board.
3. Remove the two screws (key 19) and remove the converter module and wire guide (key 42) from the housing.
4. Inspect the O-ring (key 18) and replace if necessary.

Replacement

1. Lubricate the O-ring (key 18) with a lubricating compound such as key 20 before replacing the converter module in the housing.
2. Insert the converter module and wire guide (key 42) into position in the housing (key 3). Replace the two screws (key 19) and tighten them.
3. Replace the electrical wiring removed in step 2 of the removal procedures. Do not overtighten the terminal screws. Maximum torque is 0.45 N•m (4 lbf•in).
4. Electrically calibrate the module following the procedures in the Calibration section.
5. Replace the housing cap (key 4).

Relay Maintenance

Refer to figure 10 for key number locations.

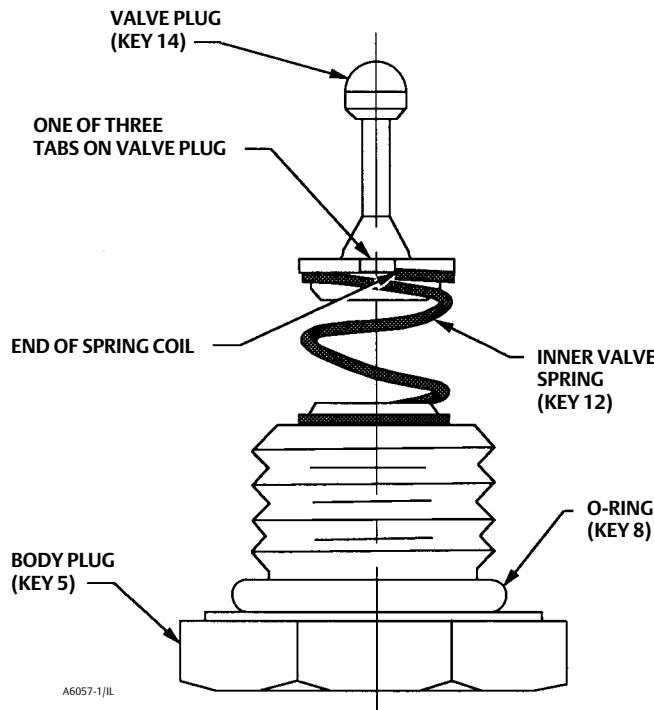
Removal

1. Remove the four mounting screws (key 7) and remove the relay from the transducer. Be careful not to lose the bias spring (key 13) and input diaphragm (key 9).
2. Remove the body block (key 2) from the relay body assembly (key 1).
3. Remove the exhaust port assembly (key 10) from the relay assembly.
4. Remove the body plug (key 5) that holds the inner valve spring (key 12) and valve plug (key 14) in place.
5. Inspect the springs, exhaust seat, valve plug, and other parts for wear or damage; replace as necessary. Note: the valve plug supply seat is an insert in the relay body (key 1). If this insert is bad, replace the relay body.
6. Ensure that the fixed restriction in the transducer housing is clear of foreign matter.
7. Make sure all parts of the relay are clean and that all passages are clear of foreign matter.

Assembly

1. Assemble the inner valve spring (key 12) onto the body plug (key 5) and fit the valve plug (key 14) onto the inner valve spring as shown in figure 9. To assure best alignment between the valve plug, inner valve spring, and body plug; fit the valve plug onto the inner valve spring so that one of the three tabs at the base of the valve plug sets at the end of the last coil of the inner valve spring.

Figure 9. Valve Plug, Inner Valve Spring and Body Plug Assembly



2. Insert the assembled valve plug, inner valve spring, and body plug into the relay body (key 1). Compress the spring and thread the body plug (key 5) into place. Then, tighten the body plug.
3. Insert two of the mounting screws (key 7) into two opposite holes of the relay body (key 1). Hold the screws in place while assembling the following parts on the relay body. The screws serve as studs to align the parts as they are being assembled.
4. When replacing the exhaust port assembly (key 10), make sure all passages and screw holes are aligned and that the hole in the center of the exhaust port assembly fits over the valve plug (key 14). Place the exhaust port assembly on the relay body (key 1). Hold assembled parts in place.
5. Make sure the tabs on the body block (key 2) align with the tabs on the relay body (key 1) and that the side with 5 holes faces the relay body. Place the body block on the assembled parts. Hold assembled parts in place.
6. When replacing the input diaphragm (key 9), make sure all passages and screw holes are aligned. Place the input diaphragm on the body block (key 2). Hold assembled parts in place.
7. Install the bias spring (key 13) into the transducer housing assembly (key 3). Make sure the tabs on the body block and relay body align with the tab on the transducer housing assembly. Place the assembled parts onto the transducer housing assembly. Thread the two mounting screws (key 7) into the transducer housing assembly. Install the remaining two mounting screws. Tighten all mounting screws to 2 N•m (20 lbf•in).
8. Perform the procedures in the Calibration section.

Parts Ordering

A serial number is assigned to each transducer and stamped on the nameplate. Always refer to this serial number when corresponding with your Emerson Process Management sales office regarding spare parts or technical information. When ordering replacement parts, also specify the complete 11-character part number from the Parts list.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Process Management should not, under any circumstances, be used in any Fisher instrument. Use of components not supplied by Emerson Process Management may void your warranty, might adversely affect the performance of the instrument, and could result in personal injury or property damage.

Parts Kits

Description	Part Number	Key	Description	Part Number
646 Transducer Repair Kit Includes keys 6, 8, 9, 10, 12, 13, 14, and 18. The O-ring for the converter module is also included in the kit.	R646X000012	6*	O-ring, nitrile	1E5477X0062
		7	Machine screw, stainless steel (4 req'd)	
		8*	O-ring, nitrile	1H8762X0012
		9*	Input diaphragm, nitrile	21B2362X012
		10	Exhaust port assembly	
		12	Inner valve spring, stainless steel	
		13	Bias spring, steel pl	
		14*	Valve plug, stainless steel	21B2370X012
		15	Wire retainer, steel pl (2 req'd)	
		16	Nameplate, w/o approvals, aluminum	
		17	Screw, stainless steel (2 req'd)	
		18*	O-ring, nitrile	1C8538X0132
		19	Screw, stainless steel (2 req'd)	
		20	Anti-seize lubricant (not furnished with transducer)	
		21	Pipe plug, use when gauge is not specified (not shown) Alloy steel pl Stainless steel	
		21*	Gauge, 0-30 psig/0-0.2 MPa/0-2 bar (not shown)	11B8579X022
		22	Anti-seize sealant (not furnished with transducer)	
		41	Vent, plastic	
		42	Wire guide, SST	
		43	Wire lug	
		44	Set Screw (LCIE)	
		---	Converter module	

Parts List

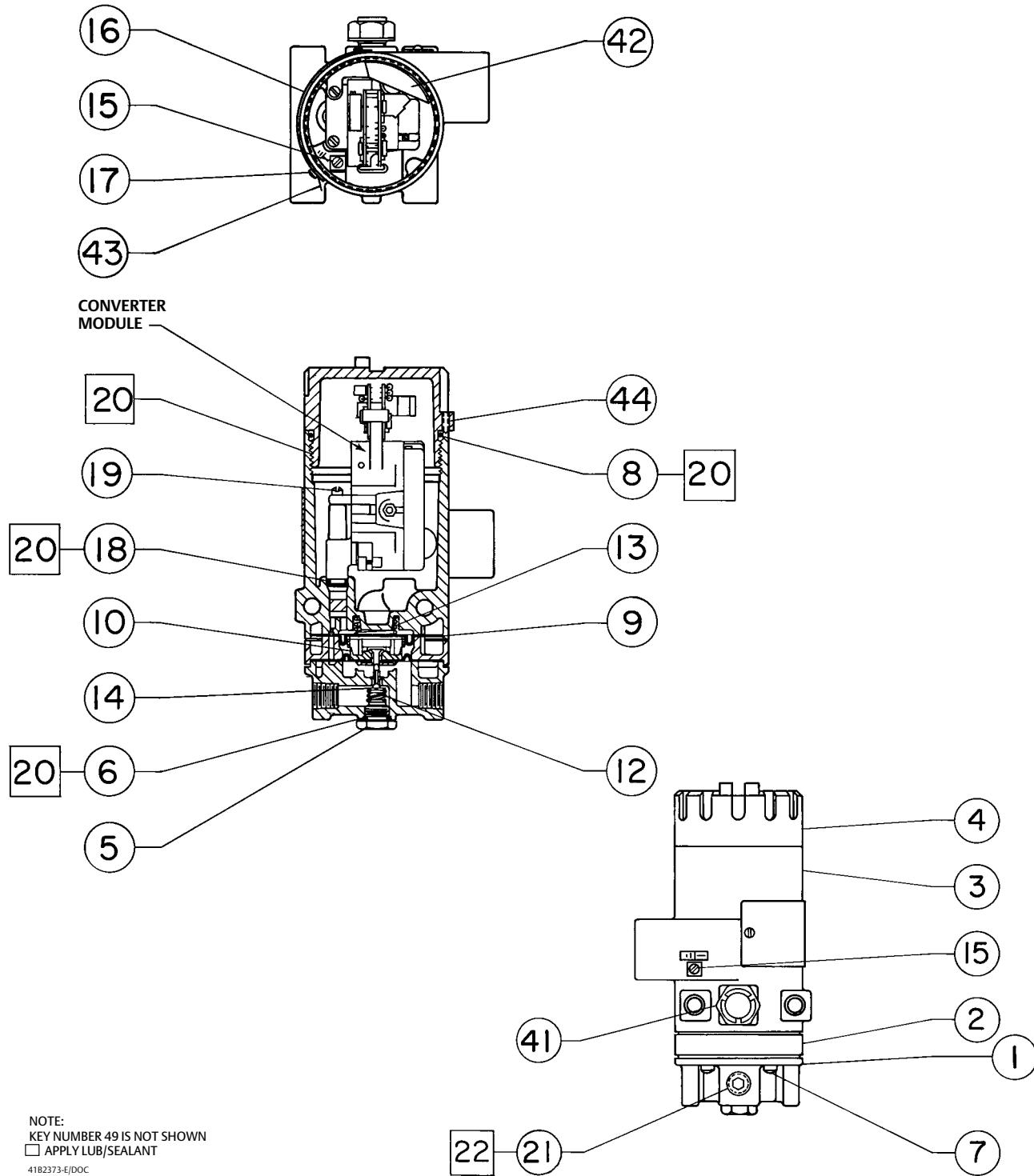
Note

Part numbers are shown for recommended spares only. For part numbers not shown, contact your Emerson Process Management sales office.

Key Description

1	Relay body assembly
2	Body block, aluminum
3	Housing assembly 1/2 NPT conduit connection
4	Housing Cap, aluminum
5	Body plug, aluminum

Figure 10. Fisher 646 Transducer Assembly



Diagnostic Connections

Note

Part numbers are shown for recommended spares only. For part numbers not shown, contact your Emerson Process Management sales office.

Description

FlowScanner™ diagnostic system hook-up
Includes pipe tee, pipe nipple, pipe
bushings, connector body, and body
protector. See figure 4 for part
identification.

Note

If the 646 transducer is used in a valve assembly with a positioner, no hook-up for diagnostic testing is required for the 646. The hook-up for diagnostic testing should be installed at the positioner.

Front Output

For units with gauges
SST fittings
Brass fittings

For units without gauges
SST fittings
Brass fittings

Side Output

For units with gauges
SST fittings
Brass fittings

For units without gauges
SST fittings
Brass fittings

Mounting Parts

Yoke Mounting With 67CFR Filter Regulator

Note

Contact your Emerson Process Management sales office for 646
mounting FS Numbers.

Key	Description
	For the following actuator types and sizes: 480 sizes 30-130; 585C all sizes; 656, sizes 40 & 60; 657 & 667, sizes 30-100; 1051 & 1052, sizes 30-60; 061 sizes 30-100; 1066 all sizes
23	Cap screw, steel pl (4 req'd)
24	Washer, carbon steel pl (6 req'd)
25	Hex nut, steel pl (4 req'd)
26	Mounting plate, steel
27	Cap screw, steel pl (2 req'd) (Not req'd for 585C)
28	Washer, carbon steel pl (6 req'd) 585C only
36	Elbow, brass for 3/8-inch copper tubing (4 req'd) 657, 1051, 1052, 1061, 1066 and 1066SR only
37	Connector, brass for 3/8-inch copper tubing (2 req'd) 480, 585C, and 667 only
---	Spacer (2 req'd) For 667 size 30
---	Cap Screw (2 req'd) For 585C only For 667 size 30

Yoke Mounting w/o 67CFR Filter Regulator

For the following actuator types and sizes:
480 sizes 30-130; 585C all sizes; 657 sizes 30-100; 667 sizes 40-100; 1051 & 1052 sizes 30-60; 1061 sizes 30-100; 1066 all sizes

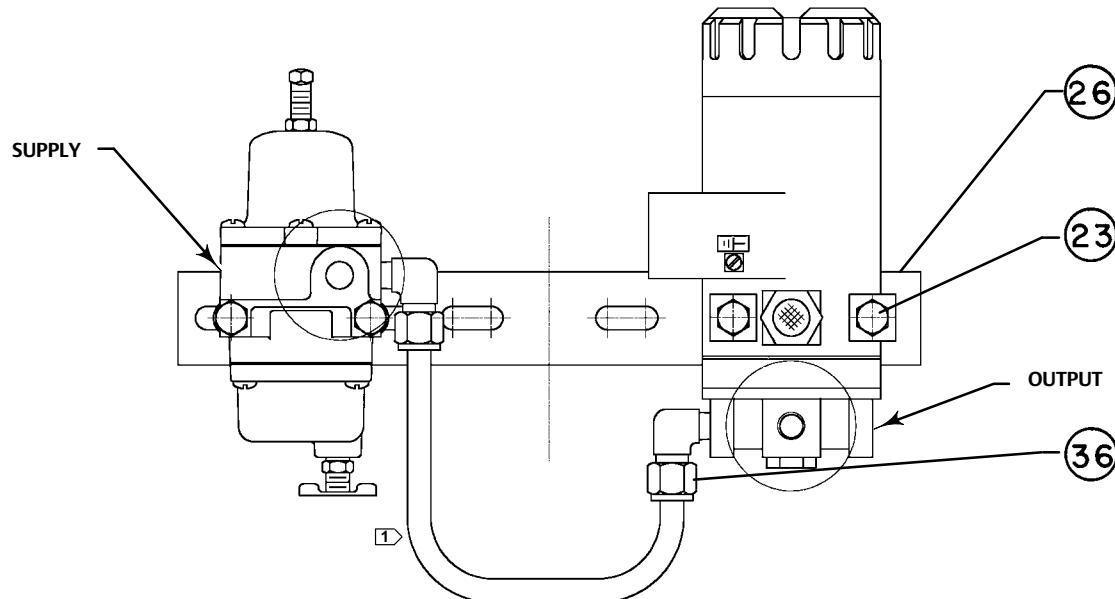
23	Cap screw, steel pl (2 req'd)
36	Elbow, brass for 3/8-inch copper tubing For 657, 1051, 1052, 1061, 1066, and 1066SR only
37	Connector, brass for 3/8-inch copper tubing For 657, 1051, 1052, 1061, 1066, and 1066SR (1 req'd) For 480, 585C and 667 (2 req'd)

Casing Mounting

For the following actuator types and sizes:
657 & 667 all sizes; 1051 sizes 30-60; 1052 sizes 20-70

23	Cap screw, steel pl With 67CFR (4 req'd) Without 67CFR (2 req'd)
24	Washer, carbon steel pl With 67CFR (4 req'd) Without 67CFR (2 req'd)
25	Hex nut, steel pl With 67CFR (4 req'd) Without 67CFR (2 req'd)

Figure 11. Typical Fisher 646 Mounting With 67CFR Filter Regulator



NOTES:

① 3/8-INCH TUBING SUPPLIED ONLY WHEN 646 IS FACTORY MOUNTED
KEY NUMBERS 24, 25, 27, 32, 33, 37, 38, 39 ARE NOT SHOWN.

38b3958-A
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Key	Description	Key	Description
26	Mounting plate, steel pl For 657 & 667 sizes 80 & 100 only With 67CFR (2 req'd) Without 67CFR (1 req'd)	24	Washer, carbon steel pl Pipestand with 67CFR (4 req'd) without 67CFR (2 req'd)
26	Mounting plate, steel pl For other actuators With 67CFR (2 req'd) Without 67CFR (1 req'd)	26	Panel (2 req'd) 45° multiple panel ⁽¹⁾ (4 req'd)
36	Elbow, brass for 3/8-inch copper tubing With 67CFR (2 req'd) Without 67CFR (1 req'd)	26	Mounting plate, steel Pipestand with 67CFR Pipestand without 67CFR 45° multiple panel ⁽¹⁾
37	Connector, brass for 3/8-inch copper tubing With 67CFR (2 req'd) Without 67CFR (1 req'd)	27	Cap screw, steel pl 45° multiple panel ⁽¹⁾ (2 req'd)
23	Cap screw, steel pl Pipestand with 67CFR (4 req'd) Pipestand without 67CFR & panel (2 req'd) 45° multiple panel ⁽¹⁾ (2 req'd)	32	Hex nut, steel pl Pipestand with 67CFR (4 req'd) Pipestand without 67CFR & panel (2 req'd) 45° multiple panel ⁽¹⁾ (4 req'd)
		33	Pipe clamp, carbon steel pl (pipestand only)
		36	Elbow, brass for 3/8-inch copper tubing Pipestand & Panel W/67CFR (2 req'd)

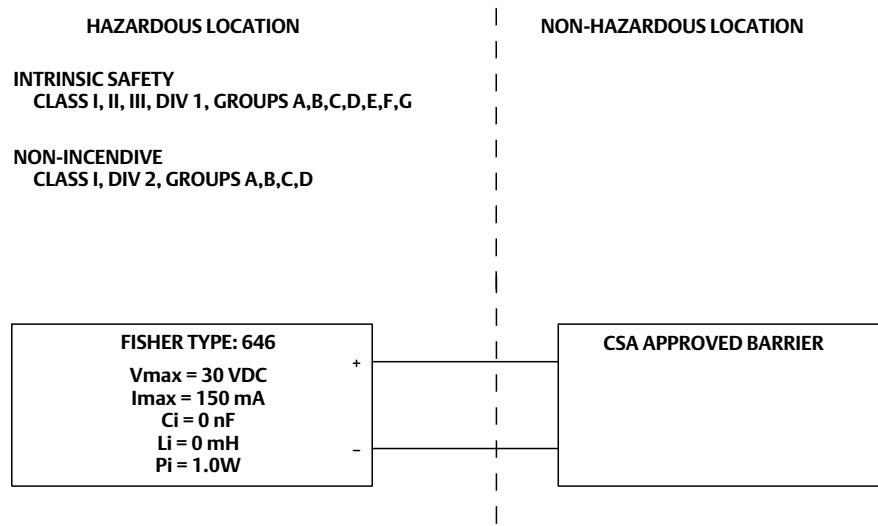
Pipestand and Panel Mounting

23 Cap screw, steel pl
Pipestand with 67CFR (4 req'd)
Pipestand without 67CFR & panel (2 req'd)
45° multiple panel⁽¹⁾ (2 req'd)

1. For panel mounting at 45° to allow close mounting of multiple transducers.

Loop Schematics

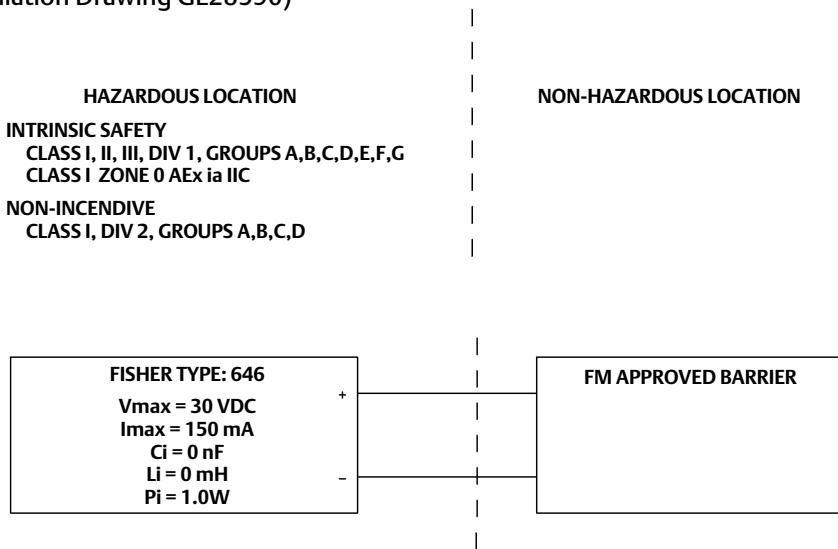
Figure 12. CSA Loop Schematic (Installation Drawing GE28591)



NOTES:

1. BARRIERS MUST BE CSA CERTIFIED WITH ENTITY PARAMETERS AND ARE TO BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S I.S. INSTALLATION INSTRUCTIONS.
2. EQUIPMENT SHALL BE INSTALLED IN ACCORDANCE WITH THE CANADIAN ELECTRICAL CODE, PART I.
3. FOR ENTITY INSTALLATION (I.S. AND N.I.): $V_{max} > V_{oc}$, $I_{max} > I_{sc}$, $C_i + C_{cable} < C_a$, $L_i + L_{cable} < L_a$.

Figure 13. FM Loop Schematic (Installation Drawing GE28590)



⚠ WARNING

FOR INTRINSICALLY SAFE APPLICATIONS: THE APPARATUS ENCLOSURE CONTAINS ALUMINUM AND IS CONSIDERED TO CONSTITUTE A POTENTIAL RISK OF IGNITION BY IMPACT AND FRICTION. AVOID IMPACT AND FRICTION DURING INSTALLATION AND USE TO PREVENT RISK OF IGNITION.

NOTES:

1. THE INSTALLATION MUST BE IN ACCORDANCE WITH THE NATIONAL ELECTRIC CODE (NEC), NFPA 70, ARTICLE 504 AND ANSI/ISA RP12.6 OR ARTICLE 505.
2. THE CLASS 1, DIV 2 APPLICATIONS MUST BE INSTALLED AS SPECIFIED IN NEC ARTICLE 501-4(B). EQUIPMENT AND FIELD WIRING IS NON-INCENDIVE WHEN CONNECTED TO APPROVED BARRIERS WITH ENTITY PARAMETERS.
3. LOOPS MUST BE CONNECTED ACCORDING TO THE BARRIER MANUFACTURER'S INSTRUCTIONS.
4. MAXIMUM SAFE AREA VOLTAGE SHOULD NOT EXCEED 250 Vrms.
5. RESISTANCE BETWEEN BARRIER GROUND AND EARTH GROUND MUST BE LESS THAN ONE OHM.
6. NORMAL OPERATING CONDITIONS 30 VDC 20 mA DC.
7. FOR ENTITY INSTALLATION (I.S. AND N.I.):
 $V_{max} > V_{oc}$, or V_t $C_i + C_{cable} < C_a$
 $I_{max} > I_{sc}$, or I_t $L_i + L_{cable} < L_a$
 $P_i > P_o$, or P_t

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